E E′ are cocks for the entrance or exit of gas, and F is a float marking the quantity of gas in the holder.

When the gas has all been expelled from the holder it is full of water, and hence conveniently ready for refilling with gas. For this purpose the cock H is closed, and G partially turned on; the water escapes as the gas enters E. A delivery tube is carried from E′ to the lecture table, and can, of course, be used as an entrance as well as an exit pipe. After the holder is filled with gas, G is shut off and H and E′ are turned on. All is now ready for use, for as soon as the cock at the burner attached to the lantern or other arrangement in the lecture-room, is turned on, the gas is displaced from the holder by the entrance of a corresponding quantity of water from the cistern B. No weights are required to be taken on and off, an equable flow of gas is secured, the turning on of the gas-cock in the lecture-room puts the whole apparatus in action, and the employment of a single cylinder considerably diminishes the original cost of the gas-holder.

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UNIVERSITY AND EDUCATIONAL INTELLIGENCE

BERLIN.—The Prussian budget contains provisions for four new professorships in the university, including two in medicine, one in philology, and one in botany. The appropriations for most of the laboratories, &c., in connection with the university have likewise been notably increased. The "Gewerbe-Akademie" is to receive an important addition in the shape of a department for the examination of iron, in which the physical and mechanical properties of the various sorts of Prussian iron—unwrought as well as manufactured—can be thoroughly tested, and officially approved. A similar institute, and the only one hitherto in Germany, has existed for a number of years at Munich, and has been of great value to the iron industry in South Germany. The lectures of Prof. Du Bois-Reymond on physiology have become so popular that no lecture-room in the university is of sufficient size to accommodate his numerous hearers.

INNSBRUCK.—The winter attendance at the university is 605, an increase of 27 on the past semester. The philosophical faculty includes 159, the medical 55, the legal 206, and the theological 185.

JENA.—The university is attended at present by 488 students, a diminution of 102 on the number of the past summer. Of the 219 in the philosophical faculty 64 study philosophy and history, 73 mathematics and natural sciences, 62 chemistry and pharmacy, and 20 political economy and agriculture. The attendance from foreign countries is but 35, and Jena is one of the few European universities where England is not represented.

SCIENTIFIC SERIALS

Annalen der Physik und Chemie, No. 11, 1877.—The residual charge of the Leyden jar, in its relation to the nature of the insulating substance, by M. von Oettingen.—On the electromotive force produced by flow of water in capillary tubes, by M. Haga.—On the same subject, by Mr. J. W. Clark.—On the connection between electromagnetic rotation and unipolar induction, by M. Edlund.—On Dr. Kerr's recently-found relation between light and electricity, by Mr. Mackenzie.—Calorimetric researches, by MM. Schulier and Wartha.—Apparatus for demonstrating the different heat-conducting powers of gases, by M. Kundt.—Observations by Adolf Rosencranz, on the influence of temperature on internal friction of liquids, by M. O. E. Meyer.—On a method of investigating the gliding friction of solid bodies, by MM. Warburg and v. Babo.—Determination of the velocity of sound by the method of coincidences, by M. Szathmari.—Velocity of wave motion in soft string, by M. Abt.—Studies on chemical volumes, by M. Ostwald.—On miargyrite, by M. Weisbach Lime, strontium, and baryta in the crystalline state, by M. Brügelmann.—On numerical determination of the constants of Weber's fundamental law, by M. Voigt.—On a simple experiment for subjectively showing the reversal of the coloured lines of flame-spectra, especially the sodium line, by M. Günther.—On completeness of exclusion of aqueous vapour from air-pumps, by M. Laspeyres.—On the applicability of fatty gases in blow-pipe operations, by M. Lohse.

Kosmos, July, 1877.—O. Caspari, on the philosophy of Darwinism.—Prof. Haeckel, in discussing Bathybius and the Monera, is very little inclined to give up the organic nature of Bathybius.—G. Jäger, on Heredity, part 2.—Carus Sterne (Dr. Krause) on the taming of the old by the young, discusses the influence of children from the Darwinian standpoint. He calls Bret Harte "probably the psychologist of deepest insight in our time."—Fräulein von Hellwald writes on the speechless primitive man.—Fritz Schultze on the origin of the culinary art.

August, 1877.—Mr. Darwin's biographical sketch of a little child is translated here.—Fritz Müller contributes observations on Brazilian butterflies on evolutional principles.—A. Dödel-Port writes on the colour and size of Alpine flowers—A. Lang, on Lamarck and Darwin, part 4, considers Lamarck's views on the relation of organic to inorganic nature.—Hugo Magnus treats on the development of the colour sense.

September, 1877.—Otto Caspari continues his discussion of the Darwinian philosophy, dealing with the problem of evil, the idea of individuation, the conditions of pleasure and disgust.—Prof. Jäger treats of colour and the colour-sense.—Prof. Krause discusses the origin of the legend of Iphis (Ovid, "Metam.," book ix.) with regard to its bearings on a morphological question.—Dr. A. Lang, in his fifth paper on Lamarck and Darwin, comes to Lamarck's theory of descent.—A comprehensive notice of Darwinian literature up to the present time is given by Dr. G. Seidlitz.

October, 1877.—Dr. B. Vetter, on design in nature.—H. Müller, on the variation in size of the coloured envelopes of flowers in relation to natural selection; a valuable paper.—Prof. Jäger, the origin of organs. Part III., locomotive organs.—Fritz Müller, on Brazilian butterflies, Part 2.—Dr. F. Weinland, on the language of primitive man.

Zeitschrift für wissenschaftliche Zoologie, vol. xxix., Part 4.—W. Schmankewitsch, on the influence of external conditions on the organisation of animals. This is a long and valuable paper, especially having to do with the influence of different degrees of concentration of salt water and varying temperatures on a number of Crustacea, as *Artemia salina*, Daphnia, Branchipus.—J. W. Spengel, on the reproduction of *Rhinoderma darwinii* (amphibian), a translation from the Spanish of N. Jimenez de la Espoda; a very remarkable case of a male brood-cavity.—B. Hatschek, on the embryonic history of the budding of *Pedicellina echinata* (polyzoan), forty-eight pages, three plates.—A. Wierzejski, on the crustacea parasitic on cephalopods, twenty-one pages, three plates.—H. von Ihering, contribution to the morphology of the kidneys of mollusca.

THE current number of the *Quarterly Journal of Microscopic Science* commences with a paper by Mr. C. S. Tomes, on the hinged teeth of the common pike, the existence of which, in other than the angler and one or two other fish, was unknown.—The Rev. Thomas Hinks has notes on the movements of the vibracula in *Cabērea boryi*, and on the supposed *common* nervous system in the Polyzoa, in which the synchronous movement of the vibracula is shown to render the existence of a common nervous system almost essential.—Dr. A. M. Marshall describes the development of the cranial nerves in the chick, in continuation of his earlier papers in the *Philosophical Transactions* and the *Journal of Anatomy and Physiology*.—Prof. E van Beneden contributes to the history of the embryonic development of the Teleosteans, showing that the germ-layers do not proceed exclusively from the blastodisc: that extra blastodic cells are developed on the deuterobiastic globe, and that there is no segmentation cavity.—Mr. S. H. Vines writes on the homologies of the suspensor of the ovule, showing its unity with the seta and foot of mosses, liverworts, and vascular cryptogams.—Prof. Lankester describes the corpusculated nature of the red vascular fluid of the earthworm.—Dr. F. Darwin describes the contractile filaments of *Amanita* (*Agaricus*) *muscaria* and *Dipsacus sylvestris*.—The last paper is a short one by Mr. Dowdeswell, on atmospheric bacteria.

SOCIETIES AND ACADEMIES

LONDON

Mathematical Society, January 10.—Lord Rayleigh, F.R.S., president, in the chair.—Mr. F. B. W. Phillips was elected a member, and Mr. R. R. Webb was admitted into the Society.—The following papers were read:—Mr. J. Hammond, on the meaning of the differential symbol D^n, when n is fractional. (Prof. Cayley gave a few references to papers on the subject by Riemann, Schröter, and others, and expressed [illegible] opinion that the matter had not yet been satisfactorily settled.)—Prof. Lloyd Tanner, on partial differential equations with several dependent variables.—Lord Rayleigh, on the relation between the functions of Laplace and Bessel (in § 783 of Thomson and Tait's "Natural Philosophy," a suggestion is made to examine the transition from formulæ dealing with Laplace's spherical functions to the corresponding formulæ proper to a plane). It is evident at once, from this point of view, that Bessel's functions are merely particular cases of Laplace's more general functions, but the fact seems to be very little known.—Mr. Ferrers, in his elementary treatise on Spherical Harmonics, makes no mention of Bessel's functions, and Mr. Todhunter, in his work on these functions, states expressly that Bessel's functions are not connected with the main subject of the book. The object of the present paper was to point out briefly the correspondence of some of the formulæ. The author showed that the Bessel's function of zero order (J_0) is the limiting form of Legendre's function, $P_n(\mu)$, when n is indefinitely great and μ ($= \cos\theta$) such that $n \sin\theta$ is finite, equal (say) to Z. This was proved by taking Murphy's series for P_n (Todhunter, § 23). In like manner Bessel's functions of higher order are limits of those Laplace's functions to which Todhunter gives the name of associated functions. A theorem was found for the general functions corresponding to the relation subsisting between three consecutive Bessel's functions $\left[\text{viz., } \tfrac{1}{2} Z\left\{J_{m-1}(z)+J_{m+1}(z)\right\} = m\,J_m(z)\right]$. Prof. Cayley stated that the results obtained were very interesting).—Mr. S. Roberts gave some results bearing upon his paper read at the December meeting.—Prof. Cayley gave an expression for the surface of an ellipsoid communicated to him by Prof. Tait.—The Chairman, Professors Cayley, Tanner, and Mr. Webb spoke upon the subject.

Chemical Society, January 17.—Dr. Gilbert in the chair.—It was announced that a ballot for the election of Fellows would take place at the next meeting of the Society (February 7).—The following papers were read:—On the luminosity of benzol when burnt with non-luminous combustible gases, by E. Frankland and L. T. Thorne. After many unsuccessful attempts to burn benzol with a smokeless flame, the authors determined the luminosity of benzol vapour after dilution with hydrogen, carbonic oxide, and marsh-gas. These gases were passed through a benzoliser kept at a constant temperature and burnt in a fish-tail burner. The following results were obtained:—1 lb. avoirdupois of benzol gives, when burnt with hydrogen, the light yielded by 5·792 lbs. of spermaceti with carbonic oxide, that of 6·100 lbs. of spermaceti with marsh-gas, that of 7·7 lbs. of spermaceti. The authors point out that this difference is probably due in part to the different pyrometric thermal effects of the gaseous mixtures.—On the action of reducing agents on potassium permanganate, by F. Jones. Hydrogen reduces permanganate, sesquioxide of manganese being formed; ammonia produces in addition a nitrate, a nitrite, and free nitrogen; phosphine, arsine, and stibine give somewhat similar reactions; oxalic acid forms manganese sesquioxide, carbonic acid, and oxygen; strong solutions of permanganate and manganese chloride, when mixed, form sesquioxide of manganese, chlorine and oxygen being evolved.—On the action of sulphuric acid on copper, by Spencer Pickering. According to the author there are only two primary reactions, in one of which copper-sulphate, sulphurous acid, and water are the products, in the other subsulphide of copper, copper sulphate, and water are formed. The author has studied the action at various temperatures and has investigated the quantity of sulphuric acid actually used, the effect of an electric current, the action of impurities in the copper, the variations produced by diluting the acid, &c.—On the analysis of sugar, by G. Jones. The author proposes to estimate sucrose volumetrically by adding a 0·1 per cent. solution to a boiling decinormal solution of permanganate, acidulated with sulphuric acid, until the dirty-brown hydrated peroxide of manganese, which is at first formed, is reduced and dissolved.—On the decomposition products of quinine, by W. Ramsay and J. Dobbie. The authors oxidised quinine with permanganate and obtained a new acid, which they have identified with Dewar's dicarbopyridenic acid, and a red amorphous substance. The same acid was obtained by oxidising Marchand's quinetin.

Geological Society, December 19, 1877.—Prof. P. Martin Duncan, F.R.S., president, in the chair.—Messrs. William Fream, J. G. Hochstätter Godfrey, Herbert Goss, and John Fowke Lancelot Rolleston were elected Fellows of the Society.—The following communications were read:—On *Argillornis longipennis*, Owen, a large bird of flight, from the eocene clay of Sheppey, by Prof. Owen, C.B., F.R.S. In this paper the author described some remains of a large bird obtained by Mr. W. H. Shrubsole from the London clay of Sheppey (already referred to in NATURE), consisting of parts of fractured humeri belonging to the right and left sides of the same species or perhaps individual, and including the head of the bone, with portions of the upper and lower parts of the shaft. The texture of the shaft, the thinness of its bony wall, and the large size of the cavity recall the characters of the wing-bones of the large cretaceous pterodactyles. The author concluded that the bones obtained by Mr. Shrubsole furnished indications of a new genus and species of flying birds, for which he proposed the name of *Argillornis longipennis.* He regarded it as probably a long-winged natatorial bird, most nearly related to *Diomedea*, but considerably exceeding the Albatross (*D. exulans*) in size.—Contributions to the history of the deer of the European miocene and pliocene strata, by Prof. W. Boyd Dawkins, F.R.S. The author commenced by referring to the difficulties attending the study of the European miocene and pliocene deer, and indicated that the majority of the known antlers may be referred to two categories—an earlier or capreoline, and a later or axidine type. To the Capreoli he referred the following species:—*Dicroceros elegans*, Lart. (= *Prox furcatus*, Hemel), *Cervus dicranoceros*, Kaup (including *C. anoceros* and *trigonoceros*, Kaup), and *Cervus Matheronis*, Gerv. (= *C. bravardi*), from the miocene, and *Cervus australis*, Gerv., and *C. cusanus*, Croizet and Jobert, from the pliocene. To the Axeides belong *Cervus Perrieri*, Cr. and Job. (including *C. issiodorensis* and *pardinensis*, of the same authors), *C. etneriarum*, Cr. and Job. (= *C. rusoides*, Pom., and *C. perollensis* and *stylodus*, Brav.), *C. suttonensis*, sp. n., and *C. cylindroceros*, Brav. (including *C. gracilis*, Brav.), all from pliocene deposits. Besides these, the author noticed a species *insertæ sedis* under the name of *Cervus tetraceros*, Dawkins, which he regards as coming nearest to the Virginian deer, or cariacou (*Cariacus virginianus*). From the examination of the antlers of these species he indicates that in the middle miocene age the cervine antler consisted of a simply forked crown, whilst in the upper miocene it becomes more complex, although still small and erect, like that of the roe deer. In the pliocene it becomes larger and more complex, some forms, such as the *Cervus dicranios*, Nesti, being the most complicated of known antlers. The successive changes are analogous to those observed in the development of the antlers of the living deer with increase of age. In the miocene we have the zero of antler-development, and the capreoline type is older than any other. The nearest living analogue of the miocene deer is, according to the antler, the muntjak (*Styloceros*), now found only in the oriental region of Asia, along with the tapir, which also co-existed with *Cervus dicranoceros* in the miocene forests of Germany. The pliocene deer, again, are generally most nearly allied to the oriental axis and rusa deer, the only exception being *Cervus cusanus*, the antlers of which resemble those of the roe, an animal widely spread over Europe and Northern and Central Asia. The alliance of these pliocene deer with those now living in the Indian region is regarded by the author as a further proof of the warm climate of Europe in miocene times, confirmatory of the conclusions arrived at by Saporta from the study of the vegetation.—On the occurrence of *Branchipus* (or *Chirocephalus*) in a fossil state, associated with *Archæoniscus*, and with numerous insect-remains in the eocene freshwater limestone of Gurnet Bay, Isle of Wight, by Henry Woodward, F.R.S. The remains of crustacea and insects noticed in this paper were obtained by Mr. E. J. A'Court Smith from a thin bed of limestone belonging to the Osborne or St. Helen's series at Thorness and Gurnet Bay in the Isle of Wight. The collection is the result of about twenty years' work. The insect-remains comprise about fifty specimens of diptera, including wings of tipulidæ and culicidæ, and the pupa apparently of a gnat, one wing of a hemipterous insect, and a flattened homopterous insect identified by Mr. F. Smith with *Triecphora sanguinolenta*; two specimens referred to the lepidopterous genus *Lithosia*; only three orthoptera, one a *Gryllotalpa*, the other two belonging to a grasshopper; thirty-five hymenopterous wings, thirty-three of which are referred to ants of the genera *Myrmica*, *Formica*, and *Camponotus*; twenty-three examples of neuroptera referred to *Termes*, *Perla*, *Libellula*, *Agrion*, *Phryganea*, and *Hemerobius*; and twelve of coleoptera, including species of *Hydrophilus*, *Dyticus*, *Curculio*, *Anobium*, *Dorcus*, and *Staphylinus*. There were also two spiders. Several species of bivalved entomostraca have also been obtained from these deposits, and identified by Prof. Rupert Jones. Of the branchipod crustacean both sexes are fossilised and beautifully preserved, the males showing their large clasping antennæ, and the females their egg-pouches, with large and very distinct disc-like bodies representing the compressed eggs. Dr. F. Goldenberg notices a fossil from the coal-measures of Saarbrück which he regards as a branchipod, and describes and figures under the name of *Branchipusites* (rectè *Branchipodites*) *anthracinus*; but this interpretation of it is at least doubtful. The author names his species *Branchipodites vectensis*. The isopods accompanying this species are referred to the genus *Archæoniscus*, M.-Edw., and one of them is identified with the *Palæoniscus brongniarti* of Milne-Edwards. The other is probably a new species, perhaps nearly allied to the existing *Sphæroma serratum*.—The chronological value of the pleistocene deposits of Devon, by W. A. E. Ussher, F.G.S., of H.M. Geological Survey.

Entomological Society, January 16.—Anniversary Meeting.—Prof. J. O. Westwood, M.A., F.L.S., president, in the chair.—The following gentlemen were elected members of the council for the present year, viz. :—Henry Walter Bates, F.L.S., F.Z.S., G. C. Champion, W. L. Distant, J. W. Douglas, Rev. A. E. Eaton, M.A., E. A. Fitch, Ferdinand Grut, F.L.S., George Lewis, R. Meldola, F.R.A.S., F.C.S., Ewd. Saunders, F.L.S., Frederick Smith, J. Jenner Weir, F.L.S., Prof. J. O. Westwood, M.A., F.L.S.—Henry Walter Bates, F.L.S., F.Z.S., was elected president, and Messrs. J. J. Weir, treasurer, F. Grut, librarian, and R. Meldola and W. L. Distant, secretaries.—An address was read by the outgoing president, in which reference was made to many of the less accessible entomological memoirs of the past year. The address was ordered to be printed, and the meeting terminated with a vote of thanks to the officers of the Society.

PARIS

Academy of Sciences, January 14.—M. Fizeau in the chair.—The following papers were read :—On the presence of oxygen in metallic silver, by M. Dumas. He shows that in the numerous experiments where silver has been used in determination of equivalents, the chemists who, after careful purification, converted it into minute grains after fusion in presence of borax, nitre, and air, have made it liable to absorb oxygen varying from 50 to 200 cubic centimetres per kilogramme. Hence much discrepancy.—On the formation of oxygenated water, ozone, and persulphuric acid during electrolysis, by M. Berthelot. The oxidising substance formed in electrolysis of sulphuric solutions is not oxygenated water, as commonly supposed, nor ozone in simple solution, but (as proved by the fact of its not being formed in other solutions, and by its reactions positive and negative) persulphuric acid. It is formed with absorption of heat. The three substances named may be simultaneously formed in electrolysis. The ozone may be changed into oxygenated water by means of ether ; the oxygenated water may be changed into persulphuric acid by concentrated sulphuric acid ; and persulphuric acid liberates gradually in the cold state the whole of its oxygen at the ordinary state without presenting any finite tension of dissociation.—On the stability of ozone, by M. Berthelot.—Experimental researches on the fractures traversing the earth's crust, especially those known as joints and faults, by M. Daubrée. One end of a long rectangular plate of the substance to be examined was seized between wooden jaws, and the other end by a wrench which gave torsion. The nature of the fractures (in gypsum and glass) are described ; geological deductions will follow in another paper.—On the recent tornado of Ercildoun (Chester Co., Pennsylvania), by M. Faye. He finds evidence in it that these great gyratory movements arise in the upper currents and travel with them ; they are propagated downwards to the ground.—On a new bed of Adamine by M. De Cloizeaux. This hydrated arseniate of zinc, found previously only at Chanarcillo, Chili, and in a mine of the Garonne, has now been found among the zinc ores of Laurium.—Note on the official report of last *séance*, by M. Pasteur.—The vibrations of matter and waves of ether ; probable consequences of the fact which serves as base of the mechanical theory of heat, by M. Favé. *Inter alia*, the author gives an interpretation of the law of radiation and absorption, slightly differing from that given by Prof. Stokes.—On the liquefaction of gases, by M. Cailletet. Inclosing in the glass tube dry air freed from carbonic acid, he cooled with protoxide of nitrogen the upper part of the tube only. When the pressure was 200 atmospheres, streams of liquid (air) were seen flowing down the lower parts. When they met the mercury they seemed to turn back. At 310 atmospheres, the mercury being in contact with the cooled part of the tube, was frozen, and on quickly removing the refrigerating apparatus it was seen to be covered with what was probably *frozen air*.—Observations of the solar protuberances during the first six months of 1877, by P. Secchi. The figures are simply tabulated.—P. Secchi presented a copy of his new work (in Italian) entitled "The Stars ; Essay in Sidereal Astronomy."—On telephony, by M. Breguet. The variations in conductivity of retort carbon have been utilised by M. Salet in a similar way to that of MM. Garnier and Pollard (see last week's report) with graphite, and with better results.—Study of the ultra violet solar spectrum, by M. Cornu. The first part of the memoir presented treats of the ultra violet spectrum from the line h' to the line O, observed with ordinary spectroscopes having glass objectives and prisms ; the second part, from O to U, the ultra violet extremity observed photographically with a spectroscope with objectives of quartz and prism of Iceland spar. The limitation of the ultra violet spectrum is found to be caused by, and to vary with, the aqueous vapour in the atmosphere. The *maxima maximorum* of extent is at the summer solstice ; but with equal height of the sun the spectrum is incomparably more extensive in winter than in summer.—On the fertility of volcanic soils, by M. Truchot. Phosphoric acid is the chief element of it.—Liquefaction of hydrogen, by M. Pictet.—On the question of the special conditions of contour of elastic plates, by M. Boussinesq.—On an industrial application of Gauss's theorem regarding the curvature of surfaces, by M. Levy.—On the function arising from development of the expression $(1 - 2ax + a^2a^2)^{\frac{-2l+1}{2}}$, by M. Escary.—On a theorem of M. Chasles, by M. Serret.—On the function of Jacob Bernouilli and on the interpolation, by M. Lipschitz.—On the preparation of curare, by M. Jobert.—Palæontological contributions, by M. Meunier.—Effect of a low temperature on a mixture of oxygenated water and sulphuric acid, by M. Boillot.

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